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TITLE: Method of manufacturing a gas absorbing element or a catalyst carrier having a honeycomb structure

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CIPS	B01J35/00	20060101
CIPS	B01J37/02	20060101
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CIPS	B01J37/00	20060101
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FIELD-OF-CLASSIFICATION-SEARCH: 502/80; 502/439 ; 502/527 ; 55/387 ; 55/523
; 55/524
See application file for complete search history

REF-CITED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4416800	November 1983	Abe et al.	N/A
502/527	N/A		
4608361	August 1986	Kanamori et al.	N/A
502/527	N/A		
4886769	December 1989	Kuma et al.	N/A
502/527	N/A		
5057482	October 1991	Fukuda et al.	N/A
502/527	N/A		

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ABSTRACT:

The present invention makes it possible to fix as much gas adsorbent or catalyst particles as possible to a gas adsorbing element or to a catalyst carrier having a honeycomb structure and also to improve the form-maintaining property of a honeycomb laminate after heat-treatment or during wet conditions so that operation becomes easy when impregnating the honeycomb laminate with a dispersion of gas adsorbent or catalyst particles. A honeycomb laminate is formed with paper including mostly ceramic fiber or glass fiber and mountain leather or with paper including mostly carbon fiber and mountain leather. The paper is then heat-treated, is impregnated with a dispersion of gas adsorbent or catalyst particles, is impregnated with a dispersion of **inorganic** binder

such as silica sol or alumina sol, and is dried.

17 Claims, 5 Drawing figures

Exemplary Claim Number: 1,10

Number of Drawing Sheets: 4

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Abstract Text - ABTX (1):

The present invention makes it possible to fix as much gas adsorbent or catalyst particles as possible to a gas adsorbing element or to a catalyst carrier having a honeycomb structure and also to improve the form-maintaining property of a honeycomb laminate after heat-treatment or during wet conditions so that operation becomes easy when impregnating the honeycomb laminate with a dispersion of gas adsorbent or catalyst particles. A honeycomb laminate is formed with paper including mostly ceramic fiber or glass fiber and mountain leather or with paper including mostly carbon fiber and mountain leather. The paper ~~is then~~ heat-treated, is impregnated with a dispersion of gas adsorbent ~~or~~ catalyst particles, is impregnated with a dispersion of **inorganic** binder ~~such as silica sol~~ or alumina sol, and is dried.

Brief Summary Text - BSTX (11):

The present invention provides a method of obtaining a catalyst carrier or a gas adsorbing element having a honeycomb structure by mixing ceramic fiber and/or powder and/or glass fiber and mountain leather and binder to prepare paper. Mountain leather is a general term for clay minerals having a large amount of active hydroxyl groups on the surface, as described in Japanese Patent Publication No. 33250/1985 (laid open to the public without examination) and is sometimes called mountain cork or mountain wood. The honeycomb structure can also be obtained by mixing carbon fiber, for example, active carbon fiber and/or **carbon particles,** for example, active **carbon particles,** and mountain leather and binder to prepare paper, by adhering by adhesive a flat sheet and a corrugated sheet of the paper to obtain a single-faced corrugated sheet adhering and laminating by adhesive the single-faced corrugated sheet to obtain the same honeycomb laminate, and heat-treating the honeycomb-laminate to promote the combination of mountain leather and fiber for forming a webbing of mountain leather. The mountain leather is then sintered to remove or carbonize organic components contained in the paper and the adhesive to make the paper porous. Then by impregnating the paper with a dispersion of catalyst or gas

adsorbent particles in **inorganic** binder sol such as silica sol and alumina sol, a large quantity of catalyst or gas adsorbent particles are fixed in **inorganic** fiber gaps and on the surface of the sheet obtained by the heat-treatment of paper. The paper is then dried. When low density paper having a high fiber gap rate is used, it can be impregnated with a large enough quantity of catalyst particles or gas adsorbent particles without heat-treating before the impregnation. In this case, the heat-treating process proceeds after the impregnation to prevent an outbreak of fire while the product is in use.

Brief Summary Text - BSTX (12):

During impregnation, the honeycomb laminate may be impregnated first with a dispersion of catalyst or gas adsorbent particles. Then, after being dried the gaps of the catalyst or adsorbent particles and fibers can be uniformly impregnated with a dispersion of **inorganic** binder such as silica sol or alumina sol containing ultra-minute particles on the order of millimcrons and is dried again. During the impregnation, in one or two processes, as above-mentioned, fibers of paper or sheet and catalyst or gas adsorbent particles are firmly combined with **inorganic** binder such as silica, alumina and mountain leather. Therefore, a highly efficient catalyst carrier or gas adsorbing element which can endure long periods of usage without danger of separation, tearing off or accompanying carrying-over of catalyst or adsorbent particles, even during treatment with a fluid having a high temperature or high velocity, is obtained.

Detailed Description Text - DETX (2):

In a first embodiment of the present invention, a corrugated sheet 1 having a wavelength of 6.3 mm and a wave height of 3.5 mm is prepared using a paper 0.22 mm thick and having a weight of 80 g/m.sup.2. The corrugated sheet 1 includes 100 weight parts of ceramic fiber, 10 weight parts of pulp, 30 weight parts of mountain leather and 5 weight parts of organic-**inorganic** mixed binder. This is adhered with a flat sheet 2 having the same composition as the above corrugated sheet 1 using an adhesive including 50% polyvinyl acetate emulsion having a 45% solid content, and 50% silica sol having a 20% solid content, to form a single-faced corrugated sheet as shown in FIG. 2. The single-faced corrugated sheets are laminated using adhesive prepared as above-mentioned by mixing organic adhesive and **inorganic** adhesive to obtain a honeycomb laminate 3 shown in FIG. 1. The bulk density of the honeycomb laminate 3 after drying is approximately 75 kg/m.sup.3. The honeycomb laminate 3 is then heat-treated for 5 hours in a baking furnace with hot air having an oxygen content less than 10% or with superheated steam, both having a temperature of 650.degree. C. The bulk density of the honeycomb laminate 3 becomes approximately 61 kg/m.sup.3. The honeycomb laminate 3 is then soaked for several minutes in suspension, as a catalyst, prepared by dispersing 40% of anatase-type titanium oxide or zeolite

(including hydrophobic zeolite) having a particle diameter of less than 5.mu. in 60 % silica sol (having a 20% solid content), and having a particle diameter of 10-20 m.mu.. The honeycomb laminate 3 is then dried for approximately 60 minutes by hot air having a temperature of approximately 300.degree. C. to obtain a honeycomb ceramic catalyst carrier or gas adsorbing element. The bulk density of the catalyst carrier or the gas adsorbing element obtained is 180 kg/m.sup.3. The quantity of the catalyst or the gas adsorbent and solid content of silica sol fixed to the honeycomb laminate is 195%.

Detailed Description Text - DETX (4):

In a third embodiment according to the present invention, a corrugated sheet 1 having a wavelength of 6.3 mm and a wave height of 3.5 mm is prepared using paper having a thickness of 0.22 mm and a weight of 60 g/m.sup.2 (the bulk density being 0.27 g/cm.sup.3) including 80 weight parts of ceramic fiber, 10 weight parts of ceramic powder, 10 weight parts of glass fiber, 10 weight parts of pulp, 40 weight parts of mountain leather, and 5 weight parts of organic binder. This corrugated sheet 1 is adhered with a flat sheet 2 having the same composition as the above corrugated sheet 1 using an adhesive. The adhesive includes a mixture of the same quantity of carboxyl-methyl cellulose aqueous solution having a 45% solid content and alumina sol having a 20% solid content, to form a single-faced corrugated sheet shown in FIG. 2. The single-faced corrugated sheets are laminated using adhesive comprising a mixture of **inorganic** and organic materials similar to those above-mentioned in the forming of the single-faced corrugated sheets to obtain a honeycomb laminate 3 shown in FIG. 1. The bulk density of this honeycomb laminate 3 after drying is approximately 73.2 kg/m.sup.3. The honeycomb laminate 3 is soaked for several minutes in the same mixture having a suspension volumes comprising approximately 30% catalyst having a particle diameter less than 5.mu. such as vanadium pentoxide, and silica sol comprising 20% silica having a particle diameter of 10-20 m.mu.. The honeycomb laminate 3 is then dried with hot air having a temperature of 120.degree. C. for approximately 60 minutes and further heat-treated with hot air having a temperature of 550.degree. C. for 5 hours to obtain a honeycomb catalyst carrier. The bulk density of the catalyst carrier obtained is 126.1 kg/m.sup.3.

Detailed Description Text - DETX (5):

In a fourth embodiment according to the present invention, an active carbon fiber paper including 50-80 weight parts of active carbon fiber having a diameter of 3-15 microns and a length of approximately 1-30 mm, 30-10 weight parts of pulp, synthetic fibers and/or glass fiber, 30-50 weight parts of mountain leather and 5 weight parts of organic binder, and having a thickness of 0.1-0.3 mm and a weight of approximately 30-150 g/m.sup.2, is provided. A

corrugated sheet 1 having a wavelength of 2.4-6.0 mm and a wave height of 1.3-4.0 mm of the above-mentioned active carbon fiber paper is adhered with a flat sheet 2 of the same above-mentioned active carbon fiber paper as above-mentioned using adhesive including thermoplastics such as an aqueous emulsion of polyvinyl acetate, to form a single-faced corrugated sheet shown in FIG. 2. The single-faced corrugated sheets are laminated using adhesive described above to obtain a honeycomb laminate 3 shown in FIG. 1. The honeycomb laminate 3 is soaked for several minutes in a mixture having the same suspension volumes comprising approximately 30% of active **carbon particles** pulverized to have a particle diameter less than 20.mu. and alumina sol containing 20% of alumina having a particle diameter of 10-20 m.mu.. Thereafter, the honeycomb laminate 3 is dried with a hot wind having a temperature of 120.degree. C. for approximately 60 minutes, and further heat-treated with a stream of nitrogen gas at a temperature of 400.degree.-600.degree. C. for 5 hours to obtain a honeycomb-shaped gas adsorbing element.

Detailed Description Text - DETX (6):

In the first to third embodiments, titanium oxide, **zeolite,** vanadium pentoxide and active **carbon particles** were described. It is a matter of course that any catalyst or adsorbent which does not deteriorate by heating at the time of manufacture can be impregnated and similarly fixed.

Detailed Description Text - DETX (9):

Also, in the method of the present invention, paper is used which is prepared by adding mountain leather and organic and/or **inorganic** binder to ceramic material or **carbon** material to form a honeycomb laminate. The honeycomb laminate 3 is heat-treated to remove all the organic components. Therefore, fire-resistance and heat-resistance of the honeycomb laminate increase remarkably without danger of outbreak of a fire or deterioration even under high temperatures. The honeycomb laminate is also chemically stable and has an extremely small pressure loss when treating fluid. Mountain leather forms **membranes** such as the webs of birds and binds with the fiber during the heat-treatment. This film-forming property of the mountain leather remarkably improves the mechanical strength of sheets of the heat-treated paper. It also improves the form maintaining quality of the honeycomb laminate under wet conditions, making an impregnating operation of a dispersion and drying at high temperature easy and also greatly improving operability of all the other manufacturing processes to shorten the entire process. The present invention also results in a simple and economical manufacture process, without requiring any special techniques. In addition, the efficiency of the fixed catalyst or adsorbent does not change because of sufficient resistance to mechanical

outside forces in handling or use.

Detailed Description Text - DETX (13):

In the present invention, the honeycomb laminate is impregnated with a mixed dispersion of catalyst or adsorbent particles and an **inorganic** binder such as silica sol or alumina sol. Therefore, **inorganic** binder such as silica sol or alumina sol and catalyst or adsorbent particles permeate simultaneously into fiber gaps of the paper. As the catalyst or adsorbent particles and paper fiber, together with mountain leather and **inorganic** binder, are treated at a high temperature, they are firmly combined by sintered mountain leather on **inorganic** fiber. Thus, an efficient product is obtained which can endure long periods of use without danger of separation, tearing-off or accompanying carrying-over of catalyst or adsorbent particles even during treatment with fluids having high temperatures or high velocities.

Detailed Description Text - DETX (14):

Even if the honeycomb laminate is impregnated first with a dispersion of catalyst or adsorbent particles having particle diameters on the micron order, dried, and then impregnated with a dispersion of **inorganic** binder such as silica or alumina consisting of ultra-fine particles having particle diameters on the millimicron order and dried, the **inorganic** binder having particle diameters on the millimicron order easily permeates into gaps of the catalyst or adsorbent particles on the micron order or into fiber gaps of the paper. This is due to the extreme fineness of the millimicron particle diameters of the **inorganic** binder. Thus, the same effect can be obtained as in the above-mentioned case of impregnating a mixed dispersion of catalyst or adsorbent particles and **inorganic** binder.

Detailed Description Text - DETX (15):

When a mixture of organic adhesive and **inorganic** adhesive is used as an adhesive in forming a single-faced corrugated sheet and/or an adhesive in laminating the single-faced corrugated sheets, organic adhesive exhibits adhesive power in the early stage in forming and laminating the single-faced corrugated sheets and **inorganic** adhesive exhibits adhesive power after removing organic materials by heat-treatment, thus contributing to reinforcement of the product.

Claims Text - CLTX (4):

c) impregnating the honeycomb laminate with a mixed dispersion of gas adsorbent particles and an **inorganic** binder; and

Claims Text - CLTX (5):

d) drying the honeycomb laminate to fix and combine the gas adsorbent particles to fiber gaps and on the surface of the papers after heat-treating with the **inorganic** binder.

Claims Text - CLTX (6):
2. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 1, wherein in said step c) the honeycomb laminate is impregnated with a dispersion of **inorganic** binder after the honeycomb laminate has been impregnated with a dispersion of gas adsorbent particles.

Claims Text - CLTX (7):
3. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 1, wherein in said step c) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (9):
a) forming a honeycomb laminate of papers prepared from a mixture containing carbon fiber and/or **carbon particles** as main components, mountain leather and binder as main components and a small amount of pulp;

Claims Text - CLTX (11):
c) impregnating the honeycomb laminate with a mixed dispersion of gas adsorbent particles and an **inorganic** binder; and

Claims Text - CLTX (12):
d) drying the honeycomb laminate to fix and combine the gas adsorbent particles to fiber gaps and on the surface of the papers after heat-treating together with the **inorganic** binder.

Claims Text - CLTX (13):
5. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 4, wherein in said step c) the honeycomb laminate is impregnated with a dispersion of **inorganic** binder after the honeycomb laminate has been impregnated with a dispersion of gas adsorbent particles.

Claims Text - CLTX (14):
6. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 5, wherein in said step c) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (17):
b) impregnating the honeycomb laminate with a mixed dispersion of gas

adsorbent particles and an **inorganic** binder;

Claims Text - CLTX (18):
c) drying the honeycomb laminate to fix and combine the gas adsorbent particles to fiber gaps and on the surface of the papers together with the **inorganic** binder; and

Claims Text - CLTX (20):
8. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 7, wherein in said step b) the honeycomb laminate is impregnated with a dispersion of **inorganic** binder after the honeycomb laminate has been impregnated with a dispersion of gas adsorbent particles.

Claims Text - CLTX (21):
9. A method of manufacturing a honeycomb-shaped gas adsorbing element according to claim 8, wherein in said step b) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (25):
c) impregnating the honeycomb laminate with a mixed dispersion of catalyst particles and an **inorganic** binder; and

Claims Text - CLTX (26):
d) drying the honeycomb laminate to fix and combine the catalyst particles to fiber gaps and on the surface of the papers together with the **inorganic** binder.

Claims Text - CLTX (27):
11. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 10, wherein in said step c) the honeycomb laminate is impregnated with a dispersion of **inorganic** binder after the honeycomb laminate has been impregnated with a dispersion of catalyst particles.

Claims Text - CLTX (28):
12. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 11, wherein in said step c) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (29):
13. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 10, wherein in said step c) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (32):
b) impregnating the honeycomb laminate with a mixed dispersion of catalyst particles and an **inorganic** binder;

Claims Text - CLTX (33):
c) drying the honeycomb laminate to fix and combine the catalyst particles to fiber gaps and on the surface of the papers together with the **inorganic** binder; and

Claims Text - CLTX (35):
15. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 14, wherein in said step b) the honeycomb laminate is impregnated with a dispersion of **inorganic** binder after the honeycomb laminate has been impregnated with a dispersion of catalyst particles.

Claims Text - CLTX (36):
16. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 15, wherein in said step b) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

Claims Text - CLTX (37):
17. A method of manufacturing a honeycomb-shaped catalyst carrier according to claim 14, wherein in said step b) the dispersion of **inorganic** binder is selected from a group consisting of silica sol and alumina sol.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	("inorganicmembrane"same"containin gcarbon").PN.	USPAT; EPO; DERWENT	OR	OFF	2006/04/10 19:06
L2	10	inorganic membrane and zeolyte	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:07
L3	2021	inorganic membrane and zeolite and carbon	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:07
L4	1	2 and zeolyte same carbon	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:11
L5	440	210/500.25	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:11
L6	0	5 and zeolyte same membrane	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:12
L7	88	5 and zeolite same membrane	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:12
L8	77	7 and carbon	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:13
L9	73	8 and porous	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:27
L10	4491	inorganic membrane same carbon	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:27
L11	306	10 and "carbon particles"	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:28
L12	3	11 and "carbon particles" same zeolite	USPAT; EPO; DERWENT	AND	ON	2006/04/10 19:28